A METHOD IN THE MANUFACTURE OF A PACKAGING LAMINATE, A PLANT IN THE MANUFACTURE OF THE PACKAGING LAMINATE, AND THE THUS MANUFACTURED PACKAGING LAMINATE

TECHNICAL FIELD

The present invention relates to a method in the manufacture of a web-shaped packaging laminate comprising a core layer of paper or paperboard, the method including the steps of coating a first side of a material web of paper or paperboard with an outer layer of thermoplastic material, and thereafter, with the aid of laser burning on the thus thermoplastic coated first side of the packaging laminate, forming a perforation line through said thermoplastic layer and said core layer. The present invention also relates to a plant in carrying the method into effect, as well as the packaging laminate produced by means of the method.

THE STATE OF THE ART AND PROBLEM

Consumer packages for foods are often manufactured from a flexible packaging material which, by cutting, folding, sealing and filling, has been converted into filled and sealed packaging containers of the desired configuration. The packaging material normally consists of a laminate which includes a core layer of a fibre material, e.g. paper or paperboard which is coated on both sides with a liquid-tight, thermoplastic material, e.g. polyethylene or polypropylene. The packaging laminate may also include other layers of plastic or metal foil in order to provide improved light barrier properties, gas barrier properties (in particular against oxygen gas) or resistance to liquids. A special type of packaging container consists of a packaging container intended for retorting in the filled state. This allows the packaging container to be stored with its contents at room temperature for an extremely long time, of the order of up to 24 months, implying that packaging containers of this type constitute completely adequate alternatives for preserved foods in metal cans or glass jars, for example for animal foods. However, this presupposes a packaging laminate particularly adapted for retorting, for example normally displaying an outer thermoplastic layer of polypropylene of greater thickness/grammage than that which is conventional for corresponding packaging laminates which are not intended for retorting.

Such a packaging laminate can be provided with a simple opening arrangement in the form of a perforation which is realised by laser burning on the thermoplastic side of the packaging laminate in such a manner that the laser beam is caused to burn through both the

thermoplastic layer and the fibre core but stop at a gas barrier layer which has higher density, normally a metal foil. However, in the laser burning operation, residual materials of the thermoplastic are formed, this residual material forming a raised ridge on either side of the elongate perforation line immediately adjacent the line. This phenomenon has been demonstrated among others in USPS 3,790,744 and also USPS 3,909,582. In packaging laminates for retorting, i.e. packaging laminates with an extra thick outer thermoplastic layer, these raised ridges of residual material from the thermoplastic will become even more accentuated. When the packaging laminate is further processed, including processing on rollers or rolling up on magazine reels, these ridges of residual material may cause problems. Thus, deposits of such residual material occur on the rollers, and in such an event production must be stopped at regular intervals for cleaning the rollers. When the packaging laminate is rolled up on magazine reels, the ridges build up in the different layers in the magazine reel on one another so that the reel becomes uneven on the outside, which seriously impedes its handling. Moreover, residual material from each ridge is deposited from the outside of the packaging laminate onto the inside of the next layer of packaging laminate in the reel, which implies an undesirable presence of residual material on the inside of the packaging laminate when this is to be reformed into packaging containers and be filled with their intended contents.

One method of solving the problem of the build-up of ridges of residual material could be grind them down. However, this is not desirable, given the problem of dust formation. In large scale production, large quantities of dust would be created which would have a harmful effect on the working environment and which would need to be taken care of.

Another, more general problem in connection with opening arrangements in the form of perforation lines is to realise a perforation which is easy to open (good accessibility) but which does not incur the risk of leakage in the event of rough handling of the packaging container.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a method and a plant are proposed in the manufacture of a laser-perforated packaging laminate whereby the above-outlined drawbacks are obviated or at least reduced. According to the present invention, the thus manufactured packaging laminate is also proposed which lacks projecting ridges of residual material substantially from its outer surface from the laser perforation, and which preferably displays

improved accessibility in the perforation, simultaneously with superior integrity, i.e. slight risk of leakage.

This and other objects are attained by means of the method, the plant and the packaging laminate as these are defined in the appended Claims.

Instead of attempting to avoid the build-up of residual material in the laser perforation, or to remove such a build-up of residual material before the packaging laminate is further processed and handled, the inventive concept herein is to conceal the ridges of residual material so that they are substantially not permitted to project out over (beyond) the outer surface of the surrounding material. In practice, this is realised in that the web-shaped packaging laminate is provided with a compression line in which the laser perforation operation is thereafter carried out. Thus, a compression line is formed on the outer thermoplastic side of the packaging laminate whereby the fibre core layer is caused to be compressed.

The compression line is formed in a compression station in the plant, the compression station comprising a compression tool with a male part in the form of a projecting compression portion around the circumference of a roller, and a smoother counter abutment, preferably in the form of a counter roller. The tool, and thereby the thus formed compression line, differ from a tool for a conventional crease line and the crease line proper, respectively, both in dimensions and in the fact that the tool displays no female part, i.e. a depression in the counter roller for receiving the male part. Thus, in a conventional crease line, the material has not substantially been compressed, but merely displaced out of the plane of surrounding material, while the material (at least the fibre core layer) in the compression line according to the present invention is *de facto* compressed, the packaging laminate being smooth on the opposite side against the compression line. Further, the compression line according to the present invention naturally differs from a conventional crease line in that a perforation line is formed therein by laser burning.

According to one aspect of the present invention, said packaging laminate, at least when it is intended for retorting, displays a total thickness of the order of magnitude of 0.2 – 0.6 mm, preferably 0.3 – 0.5 mm. On the opposing side to the outer thermoplastic layer which is pressed down in the compression line, the packaging laminate displays a gas barrier layer, preferably a metal foil such as aluminium foil (Alifoil) as well as at least one inner thermoplastic layer, intended to be in contact with the contents of the packaging container.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described in greater detail hereinbelow, with particular reference to the accompanying Drawings. In the accompanying Drawings:

Fig. 1 shows a compression tool for carrying the method according to the invention into effect;

Fig. 1A shows a part A of the tool according to Fig. 1 in greater detail and in cross section;

Fig. 2 is a cross section through a compression line including a perforation line in a packaging laminate according to the present invention; and

Fig. 3 shows a production line for the present invention.

Fig. 1 shows a compression tool for carrying the method according to the present invention into effect, the tool carrying generic reference numeral 10. The compression tool 10 includes a roller 12 with a central portion 14 of larger diameter than the roller 12 proper. On this portion 14, there are disposed two projecting compression portions 16 which extend around the circumference of the roller 12 and the central portion 14. That two compression portions 16 are provided with slight interspace is because the present invention, in the illustrated embodiment, is intended to be utilised in connection with a plant of the type described in SE-C-516 532, i.e. a production plant where the web-shaped packaging laminate is provided with a printed region centred in relation to a longitudinal centre line, the material web being, in a step following the perforation step, divided up into two webs of a final width through incisions in said centre line. The centre line of the packaging laminate is thus disposed according to the present invention centrally between the two projecting compression portions 16 in Fig. 1.

A counter roller 18 with a smooth casing surface is disposed to constitute a counter abutment in the compression operation. A nip or gap 20 between the roller 12 and the counter roller 18 is adjustable, whereby the compression tool 10 may be set, on the one hand, for different thicknesses of the packaging laminate and, on the other hand, for different depths of the compression line 30 (Fig. 1 A).

Fig. 1 A shows the section A in Fig. 1 in greater detail as well as in cross section. Here, it is also shown how the packaging laminate 22 is disposed between the roller 12 and the counter roller 18.

The packaging laminate 22 includes a fibre core layer 24 of paper or paperboard, as well as an outer thermoplastic coating layer 26 which displays a surface weight or grammage

of 20–50 g/m², preferably 20-40 g/m² and preferably also includes a thermoplastic material selected from the group essentially comprising polyethylene and polypropylene, most preferably polypropylene. On its opposite side, the packaging laminate 22 displays a gas barrier layer, preferably an aluminium foil (Alifoil), as well as at least one liquid barrier layer of thermoplastic material. In the Figure, the gas barrier layer and liquid barrier layer(s) have jointly been given reference numeral 28.

The projecting compression portion 16 on the roller 12 is preferably 1-3 mm, and even more preferably 1.5-2.5 mm wide and preferably 0.2-2 mm, and even more preferably 0.2-1 mm high above the surrounding surface of the roller 12 (i.e. in reality the surface of the central portion 14). Normally however, the entire height of the projecting compression portion 16 of the compression roller 12 is not utilised, but only its upper region is pressed down into the packaging laminate 22. Both the inner and outer angles of the projecting compression portion 16 are provided with gently rounded radii, with a view to not damaging the thermoplastic layer 26.

The projecting compression portion 16 on the roller 12 compresses the core layer 24, normally by at most 70%, preferably at most 60%, but at least 20%, preferably at least 30% of its original and surrounding thickness in the thus formed compression line 30. As a result, the thermoplastic layer 26 sinks down into the compression line 30 proper, but is not subjected to any actual compression itself.

Fig. 2 shows the packaging laminate 22 after a laser perforation line 32 has been formed substantially centrally in the compression line 30. The compression line 30 is considerably wider than the perforation line 32, preferably at least 1.5 times as wide, and even more preferably at least twice as wide, but at most ten times as wide, preferably at most five times as wide, in which even the compression line 30 is preferably 1-3 mm, and even more preferably 1.5-2.5 mm wide and 0.1-0.3 mm, preferably 0.15-0.25 mm deep. The term 'width' of the perforation line 32 is here taken to signify the width of the holes themselves through the thermoplastic layer 26 and the core layer 24, i.e. not including the width of residual material 34 built up around the perforation line after the laser burning operation. On the other hand, the width of the compression line 30 should not be such that it may encompass both the width of the perforation line 32 proper and the residual material 34 built up around the perforation line. The depth should be the least possible depth that permits the ridges of residual material 34 after the laser perforation substantially to be located completely below the level of the surrounding surface of the packaging laminate 22.

Fig. 3 shows a plant or production line for carrying the present invention into effect. A web-shaped core layer of paper or paperboard is rolled up on a magazine reel 36. In a lamination station (coating station) 38, an outer layer of thermoplastic material, e.g. PE (polyethylene) or PP (polypropylene) is extruded on the first side of the core layer. The web-shaped material 40 is also provided with other layers, for the formation of the packaging laminate 22 according to Fig. 1A. These additional coating/lamination operations do not, however, form part of the present invention and will not, therefore, be described in detail here. The packaging laminate is possibly rolled up on a reel (not shown) and transferred to another production line which commences with application of printing ink on the first side of the packaging laminate, i.e. that side provided with the outer thermoplastic layer 26, in one or more printing works 42a-f. The web-shaped packaging laminate thereafter runs further to a compression station 44 where the compression tool 10 according to Fig. 1 and Fig. 1A execute the compression line according to the present invention in the packaging laminate. Thereafter, the packaging laminate is led to a perforation station 46 where a conventional laser burner 48 is disposed to form the perforation line 32 proper (Fig. 2). The packaging laminate now provided with perforation line(s) is led further via rollers 52 and is once again rolled up on a reel 54 in order thereafter to be transferred to additional treatment and processing stations. Such subsequent treatment operations may, for example, consist of creasing and severing the web into a plurality of narrower webs and/or into individual blanks. It is also conceivable that the printing operation and/or the creasing operation be carried out at other sites in the production line.

The present invention is not restricted to the embodiments disclosed here, but may be varied without departing from the scope of the appended Claims.